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49 3-D Gallery

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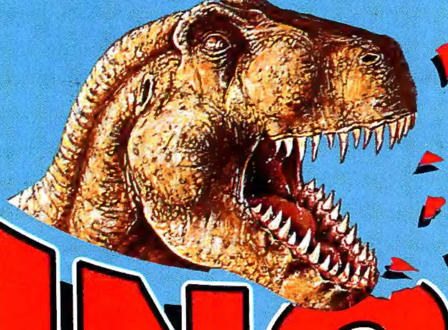

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TSINTAOSAURUS

Duckbilled *Tsintaosaurus*, found in China, was one of the last living dinosaurs on Earth.

T*sintaosaurus* was a crested hadrosaur which grew to be longer than an elephant. It was tall enough to rest its hands on an adult human's shoulders.

A CHINESE PUZZLE

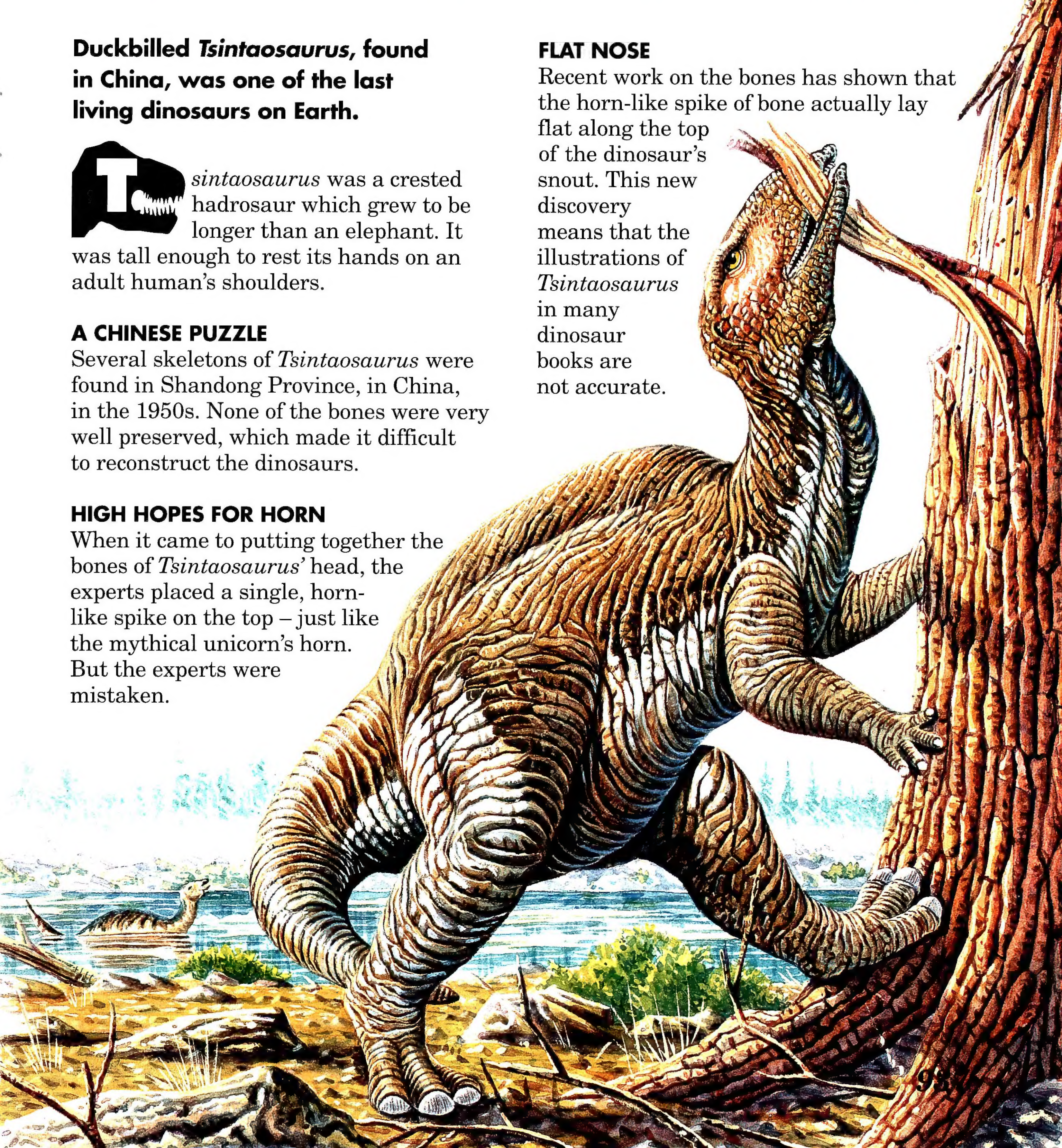
Several skeletons of *Tsintaosaurus* were found in Shandong Province, in China, in the 1950s. None of the bones were very well preserved, which made it difficult to reconstruct the dinosaurs.

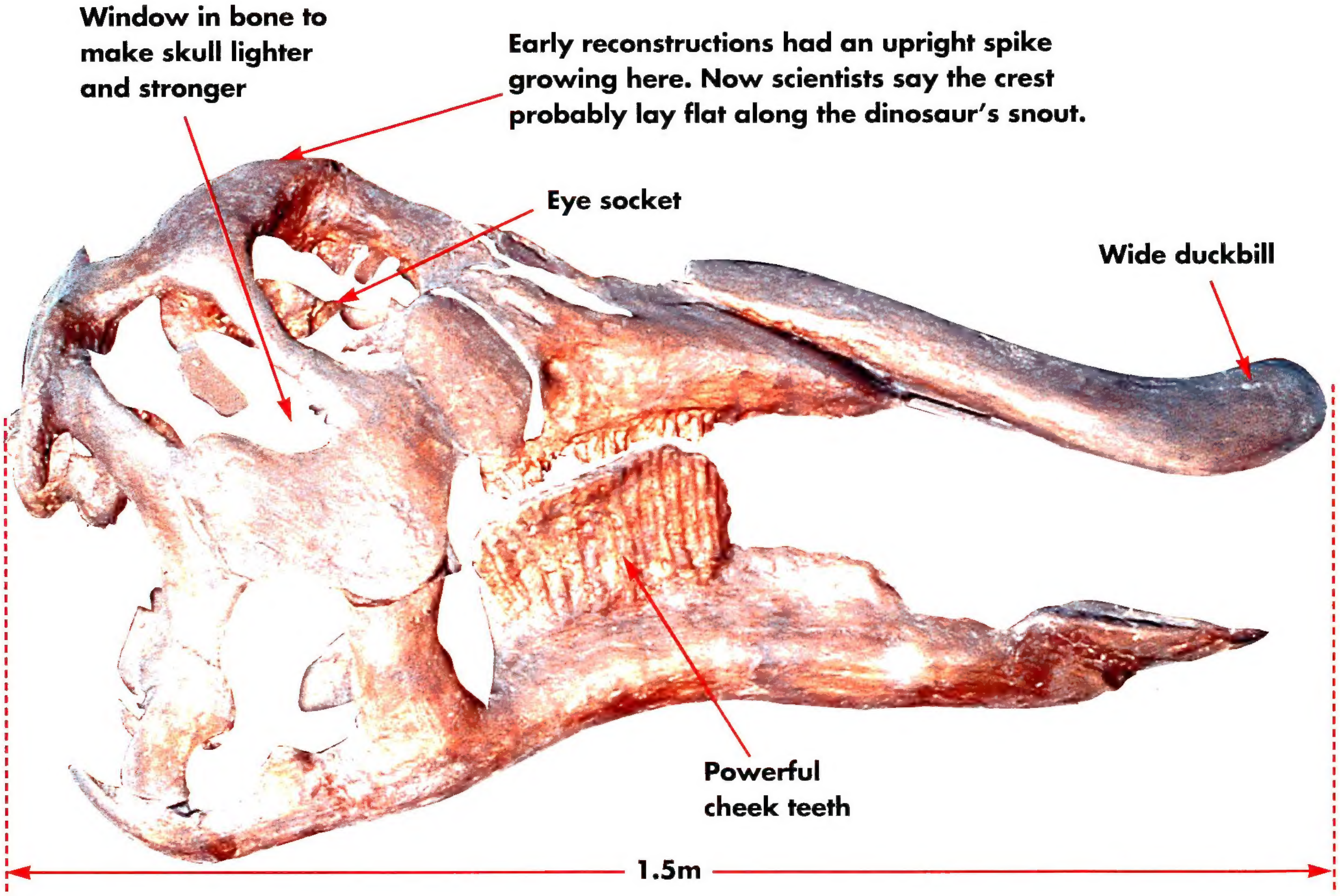
HIGH HOPES FOR HORN

When it came to putting together the bones of *Tsintaosaurus'* head, the experts placed a single, horn-like spike on the top – just like the mythical unicorn's horn. But the experts were mistaken.

FLAT NOSE

Recent work on the bones has shown that the horn-like spike of bone actually lay flat along the top of the dinosaur's snout. This new discovery means that the illustrations of *Tsintaosaurus* in many dinosaur books are not accurate.




Window in bone to make skull lighter and stronger
Early reconstructions had an upright spike growing here. Now scientists say the crest probably lay flat along the dinosaur's snout.
Eye socket
Wide duckbill
Powerful cheek teeth
1.5m

WHAT SORT OF CREST?

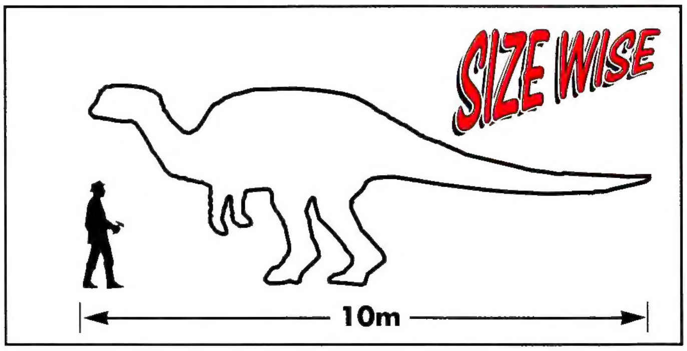
Scientists are sure that *Tsintaosaurus* had a crest – they have found the dent in the top of its skull where this grew. But they have not found the crest itself. It may have been similar to the crest of *Saurolophus,* the only other crested dinosaur found in China. *Saurolophus* had a longish spine pointing backwards from the top of its head.

WARNING NOTE

Tsintaosaurus, like other hadrosaurs, may have made distinctive noises to alert its herd to a nearby predator. It may have had a flap of skin above its face, at the base of its crest. When filled with air, the flap probably inflated like the nose of an elephant seal of today. This helped *Tsintaosaurus* produce a bellowing sound which other dinosaurs recognised.

MONSTER FACTS

- **NAME:** *Tsintaosaurus* (sin-toh-saw-rus) means 'reptile from Tsintao'
- **SIZE:** up to 10m long
- **FOOD:** plants
- **LIVED:** about 70 million years ago in the Late Cretaceous Period in Shandong Province, China



Is it true that we know what hadrosaurs liked to eat?

Yes. Scientists have analysed the stomach contents of some well-preserved hadrosaur fossils and found that apart from plants, duckbilled dinosaurs also enjoyed pine cones, conifer needles and even the bark of trees. Their batteries of cheek teeth were able to crush the toughest food that other dinosaurs could not manage.

SOCIABLE SIGNS

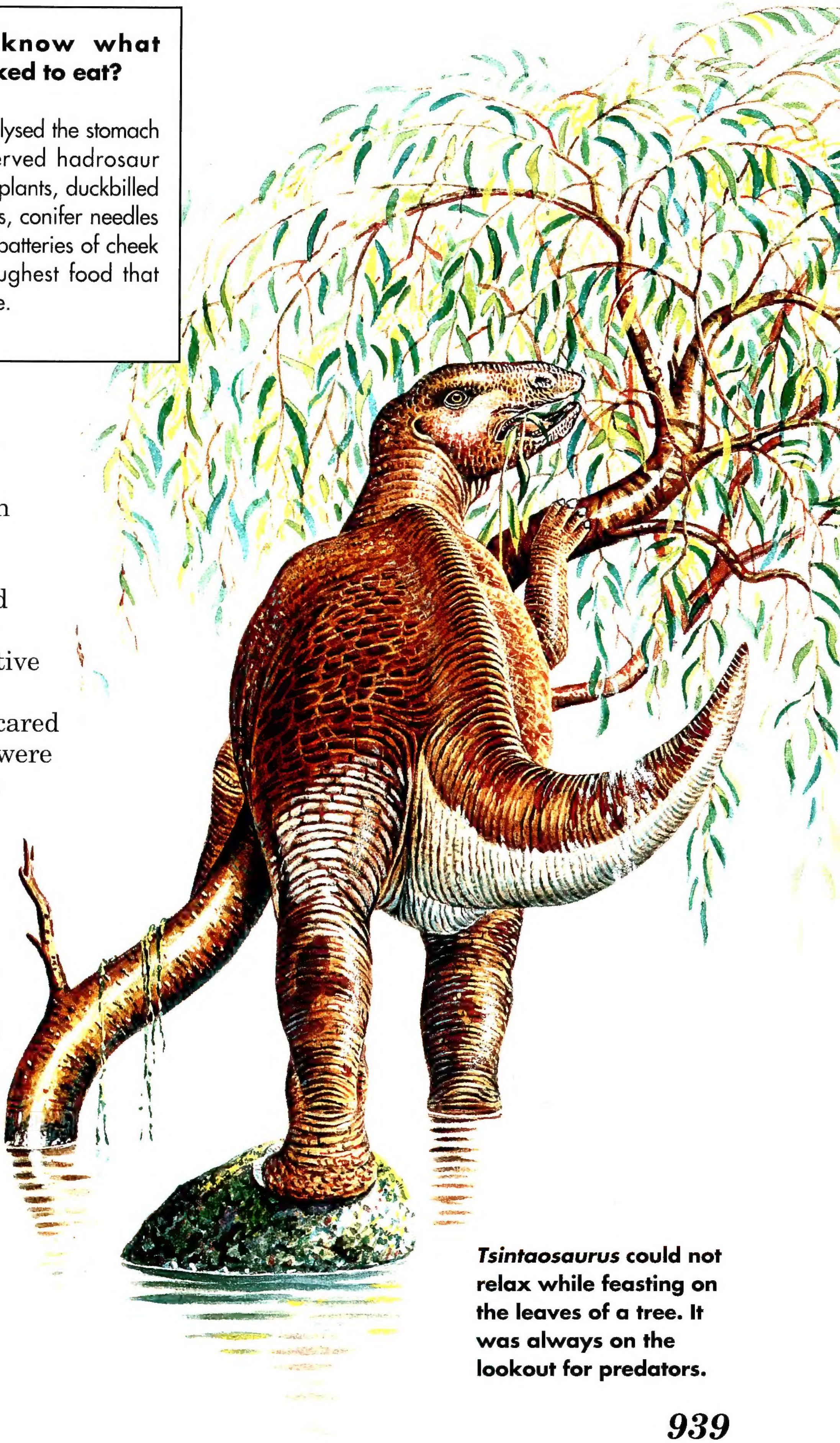
Tsintaosaurus was probably a very sociable dinosaur. The discovery of bone beds in Montana, USA showed that some hadrosaurs travelled in huge groups. They created nesting colonies where their young were cared for in relative safety. *Tsintaosaurus* was probably a good parent and cared for its hatchlings until they were big enough to leave the nest.

ALL EYES AND EARS

Plant-eaters like *Tsintaosaurus* were always at risk from predators as they filled their broad beaks with leaves and shoots. They relied on good eyesight and hearing to stay alive.

DEEP WATER

Once alerted, the dinosaurs probably headed for a place where they could swim safely in deep water, leaving the predator stranded in the shallows.



***Tsintaosaurus* could not relax while feasting on the leaves of a tree. It was always on the lookout for predators.**

SILVISAURUS

***Silvisaurus* was an armoured dinosaur as long as a small car.**

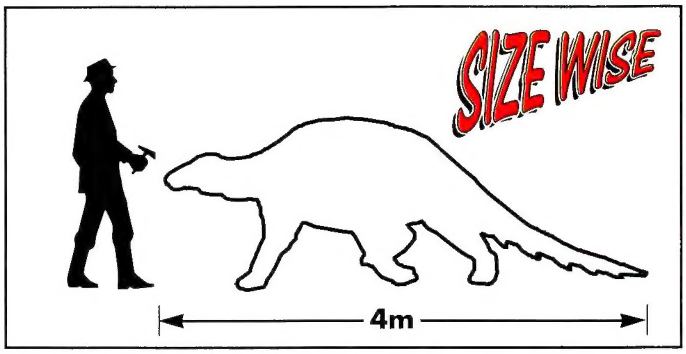
When *Silvisaurus* was found in 1960, it took days of hard work in a laboratory to get the skeleton out of the rock. It was lying in a bed of ironstone at the bottom of a stream where cattle drank. The constant pounding of the cows' hoofs had damaged the fossils but the skull of the skeleton was intact.

UNUSUAL TEETH

Most nodosaurids have a toothless, horny beak at the front of their jaws for nipping off leaves and shoots. But *Silvisaurus* had eight or nine small, pointed teeth at the front of its upper jaw. If it had a beak, this must have been at the very tip of its snout.

SHORT LEGS

Silvisaurus was not a graceful dinosaur. Supported by short, strong legs, its heavily armoured body was slow and lumbering. Its neck was quite long and its cheek bones big in comparison with those of its relatives.

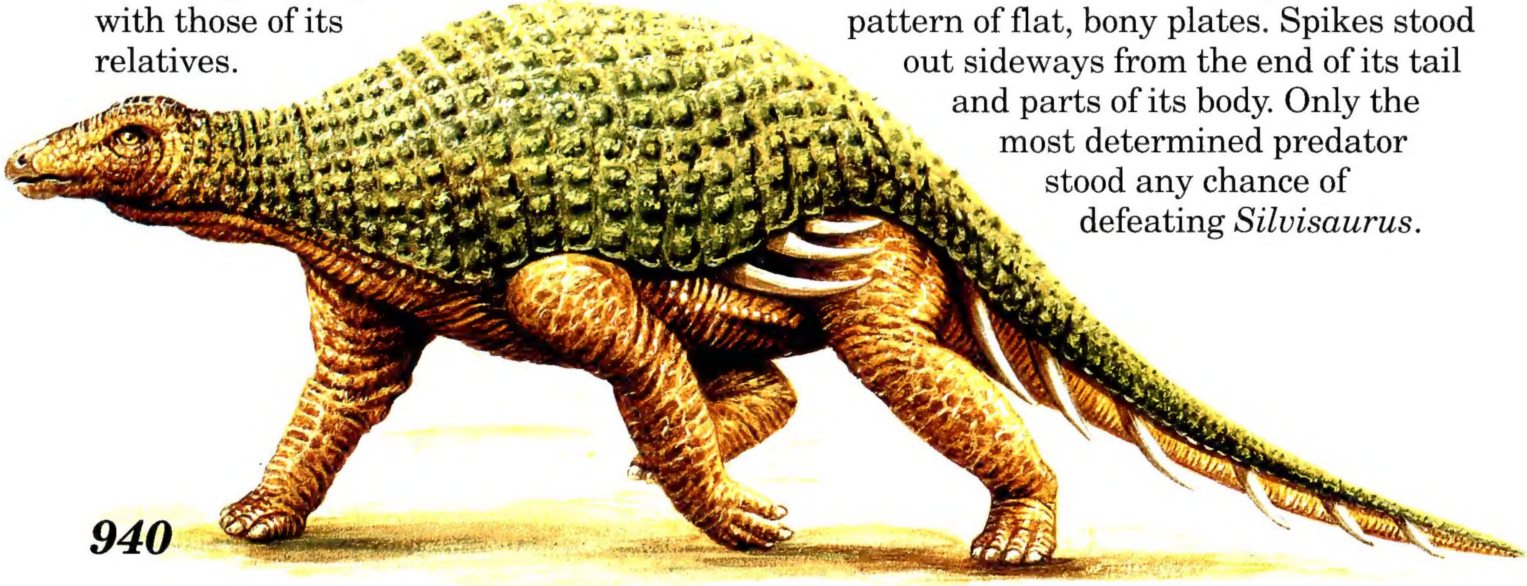


MONSTER FACTS

- **NAME:** *Silvisaurus* (sil-vee-saw-rus) means 'forest reptile'
- **SIZE:** 2.5 – 4m long
- **FOOD:** plants
- **LIVED:** about 120 million years ago in the Early Cretaceous Period in Kansas, USA

SPIKED TAIL

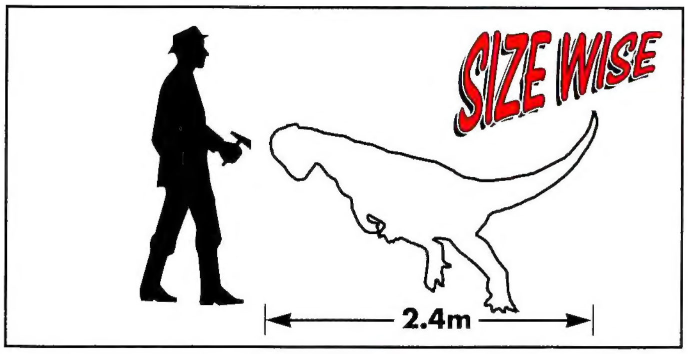
As it plodded through Cretaceous forests like a hungry tank, *Silvisaurus* fed off low-growing plants and ferns. It had little to fear from its meat-eating neighbours. Its broad body was covered by a mosaic pattern of flat, bony plates. Spikes stood out sideways from the end of its tail and parts of its body. Only the most determined predator stood any chance of defeating *Silvisaurus*.



PRENOCEPHALE

The smooth rounded skull of *Prenocephale* was discovered in the soft sandstone of the Gobi Desert.

The remains of dome-headed *Prenocephale* were so well-kept that even the most delicate bones were visible. Around the base of its thick dome and along the sides of its face, was a row of knobbly, decorative bumps.



MONSTER FACTS

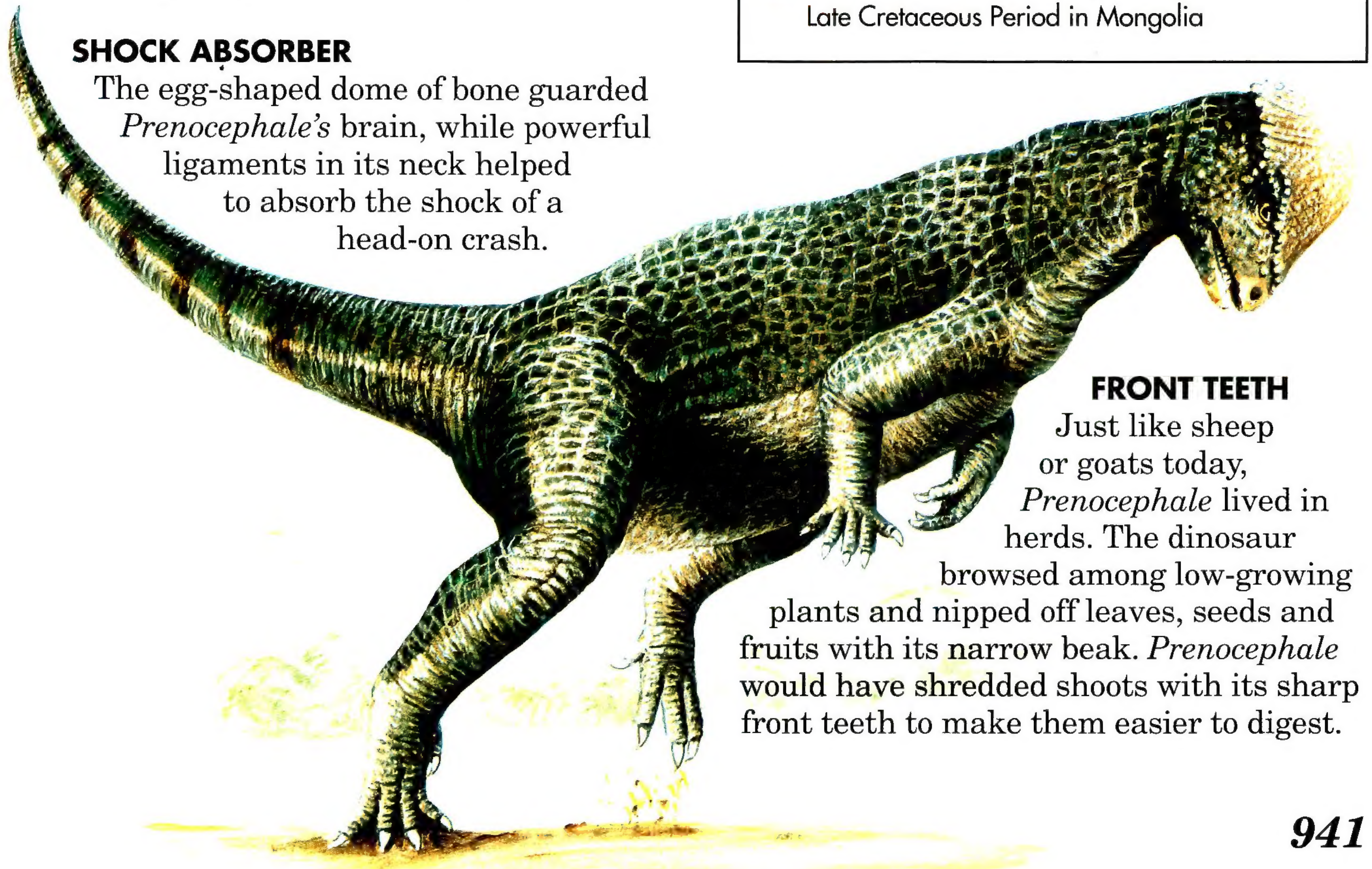
- **NAME:** *Prenocephale* (pren-oh-sef-al-ee) means 'sloping head'
- **SIZE:** 2.4m long
- **FOOD:** plants and possibly fruits and seeds
- **LIVED:** about 70 million years ago in the Late Cretaceous Period in Mongolia

BATTERING RAM

With its nose pointing down, *Prenocephale* looked like a walking battering ram and could face charging predators. Males in each herd probably fought in violent head-butting competitions to attract mates.

SHOCK ABSORBER

The egg-shaped dome of bone guarded *Prenocephale's* brain, while powerful ligaments in its neck helped to absorb the shock of a head-on crash.



FRONT TEETH

Just like sheep or goats today, *Prenocephale* lived in herds. The dinosaur browsed among low-growing plants and nipped off leaves, seeds and fruits with its narrow beak. *Prenocephale* would have shredded shoots with its sharp front teeth to make them easier to digest.

Food chains and webs

A list of who eats what is called a food chain. We can use information about what modern animals eat to build up a food chain for dinosaurs.

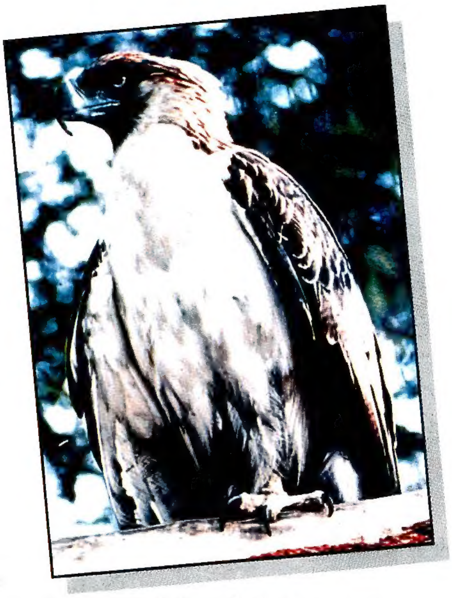
Why is a lion from Africa like *Tyrannosaurus rex*? The clue is in the food. Lions eat meat and so did *T rex*. Studying what an animal eats is an essential part of the science known as ecology. Two important parts of ecology are food chains and food webs.

WHO EATS WHAT?

Animals eat food to get body-building nutrients (goodness) and energy for life. When *T rex* ate *Triceratops* 66 million years ago, it was taking in meat that contained nutrients and energy. A lion eats a zebra in Africa today for the same reasons. Where do the meat's nutrients and energy come from? From plants.

What is? ECOLOGY

Ecology looks at how animals and plants live in their environment. It studies where they live, how they feed, their predators and competitors, their homes, and how they fit into their surroundings. A knowledge of ecology is vital for conservation. It's no good trying to save a species unless you can give it the right place to live, suitable food, and so on. Ecology tells us these things.



This eagle's hooked beak is for ripping flesh. Meat-eaters are at the top of food chains that begin with the Sun's energy and plants.

FOOD CHAINS

A food chain is a list of who eats what. Long ago, *Triceratops* ate plants, and *T rex* ate *Triceratops*. Today, zebra eat grass, and lions eat zebra. These food chains are quite similar. Both have three links. Both begin with plants, and go on to herbivores (plant-eaters), then to carnivores (meat-eaters). Using information from today's food chains, we can look back to the Age of the Dinosaurs, and begin to build up food chains from prehistoric times.

PLANT POWER

If you trace back any food chain far enough, you'll find that it begins with plants. Think of an eagle soaring over a tropical forest. With its strong, sharp talons and fierce, hooked beak, it is a pure carnivore. It eats only animals, such as snakes. But the snake ate small birds, which ate caterpillars, which ate plants. This food chain has five links in all. But it still begins with plants.

ENERGY FROM THE SUN

So all animal life depends on plants. In turn, plants get their energy from the Sun by trapping the energy in sunlight. So life on Earth is driven by energy from the Sun.

CHAINS TO WEBS

Think about food chains. Lions eat other prey besides zebra. Most animals eat a variety of foods. So food chains are linked to each other. Linked food chains are called food webs. To find out what dinosaur food chains and webs were like it is first helpful to study modern ones.

WEAVING WEBS

In African grasslands there are different sorts of grasses and trees, eaten by zebra, wildebeest and gazelles. These are prey to lions and hyenas. If we know enough about their eating habits we can draw a food web for them. These usually include only the main items in an animal's diet.

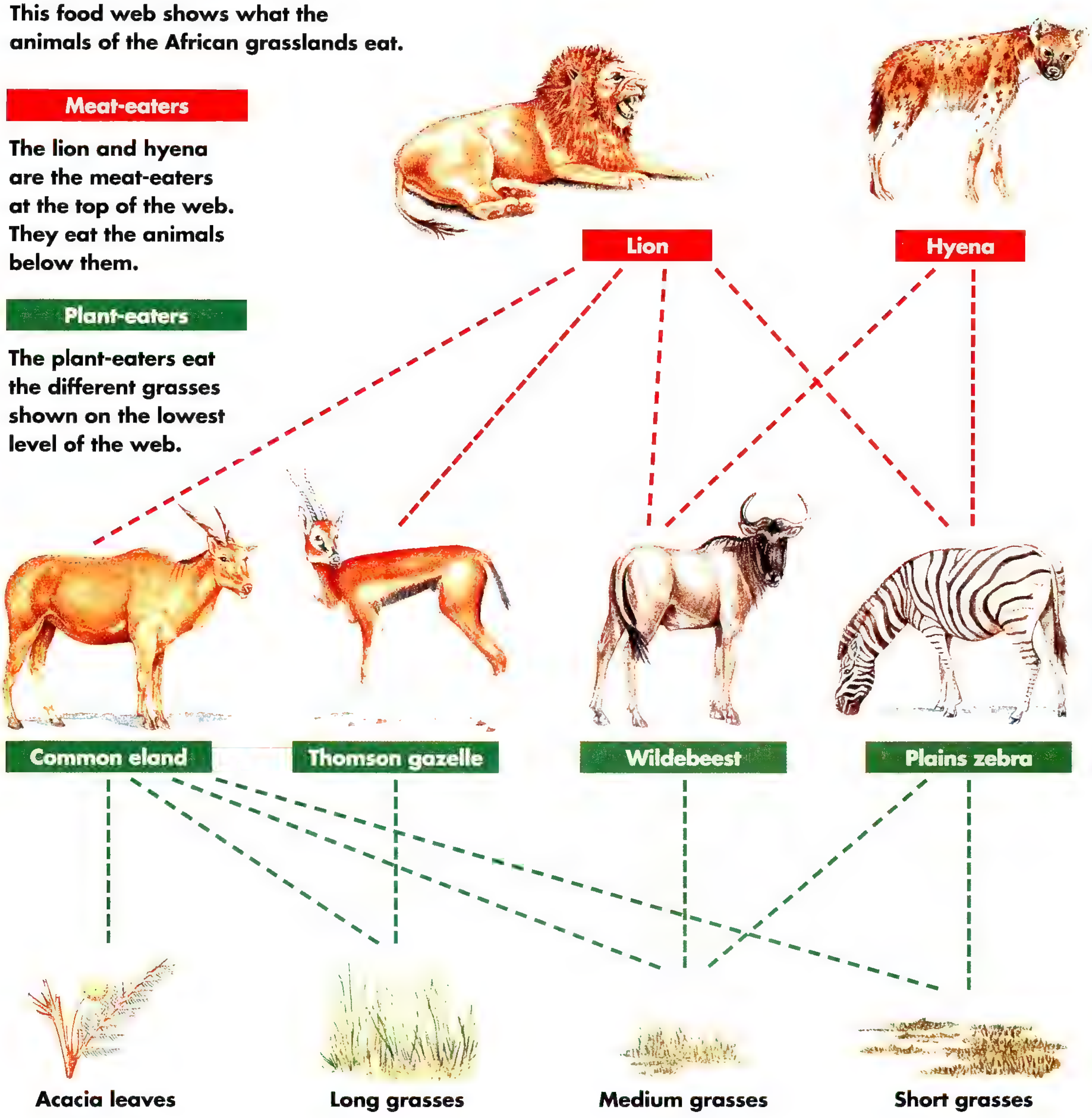
This food web shows what the animals of the African grasslands eat.

Meat-eaters

The lion and hyena are the meat-eaters at the top of the web. They eat the animals below them.

Plant-eaters

The plant-eaters eat the different grasses shown on the lowest level of the web.



A DINOSAUR FOOD WEB

Can we build a food web from dinosaur times? Let's choose North America about 66-70 million years ago. To start, we have to discover what dinosaurs ate. As usual this is expert guesswork based on fossils. Fossils of leaves and stems, perhaps with stomach stones (gastroliths), show whether a dinosaur was a plant-eater. Fish scales, insect wings or bones and teeth show the type of meat-eater. The fossils of dinosaur droppings (coprolites) also contain the leftovers of what a dinosaur ate for dinner.

STARTING THE WEB

Begin with plants. Fossils show that conifers, ferns, cycads, flowers and trees grew. These go along the bottom of the web. They are the primary producers – the makers of food for the whole web.

THE HERBIVORE LEVEL

After the producers come the consumers – the animals. The first are the herbivores (plant-eaters). They go on the layer above the plants. *Anatotitan* was one. Fossil hadrosaur stomachs show they ate conifer needles and cones. So we can link the conifers and cycads on level one to *Anatotitan* on level two.

CHAIN OF CLUES

One dinosaur could eat another only if the two lived at the same time and in the same place. A dinosaur with weak teeth, like *Diplodocus,* could not kill and rip apart animal flesh. And the pointed teeth of *Allosaurus* were not for eating leaves!

OTHER ANIMALS TOO

Dinosaurs were not the only animals of their age. There were insects, worms, amphibians, birds and mammals. All are important in food webs today, and they were also important in prehistoric times.

Meat-eaters

***T rex* was at the top of the dinosaur food web, as it preyed on almost everything.**

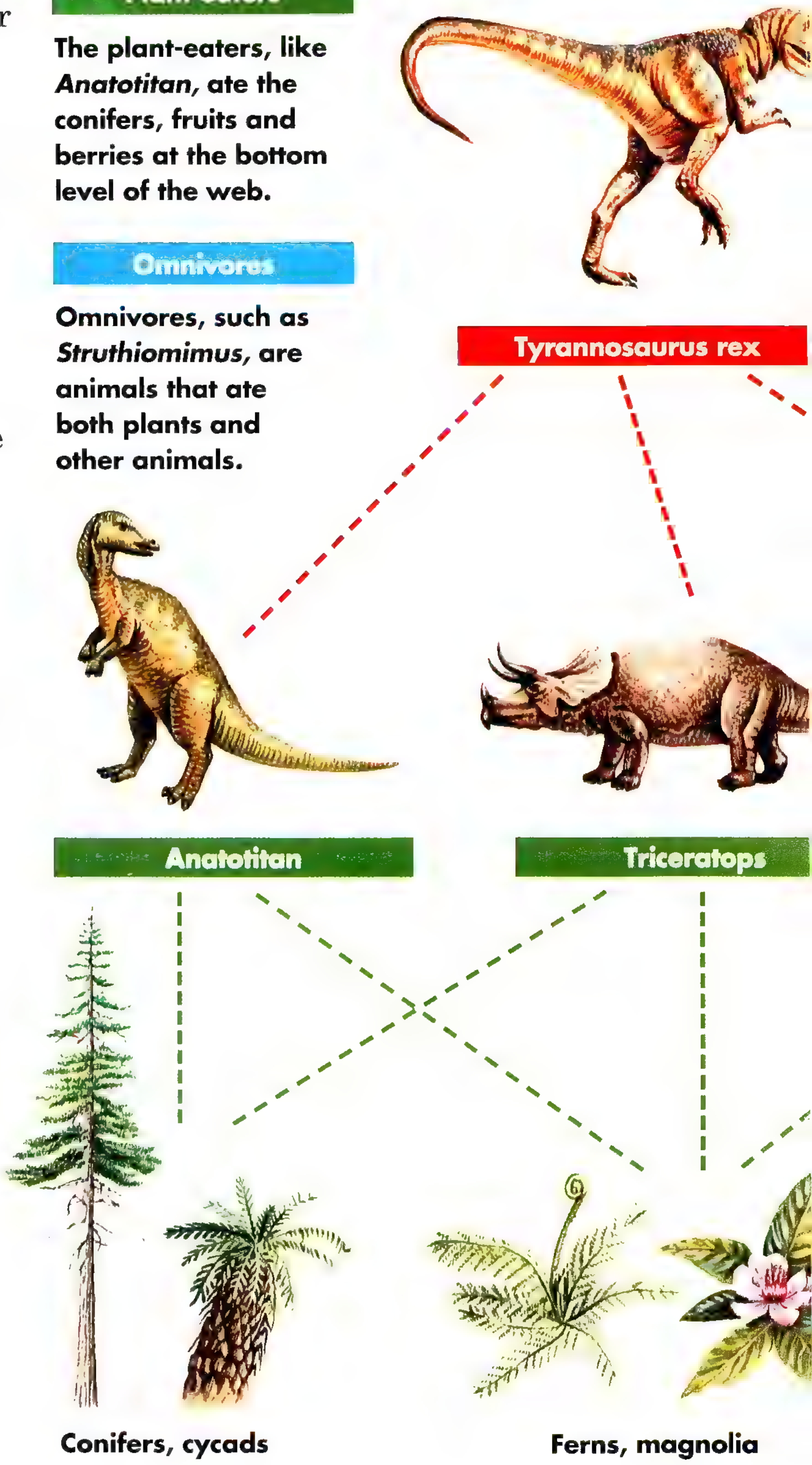
Plant-eaters

The plant-eaters, like *Anatotitan*, ate the conifers, fruits and berries at the bottom level of the web.

Omnivores

Omnivores, such as *Struthiomimus*, are animals that ate both plants and other animals.

This food web shows what the dinosaurs of North America may have eaten 66–70 million years ago.

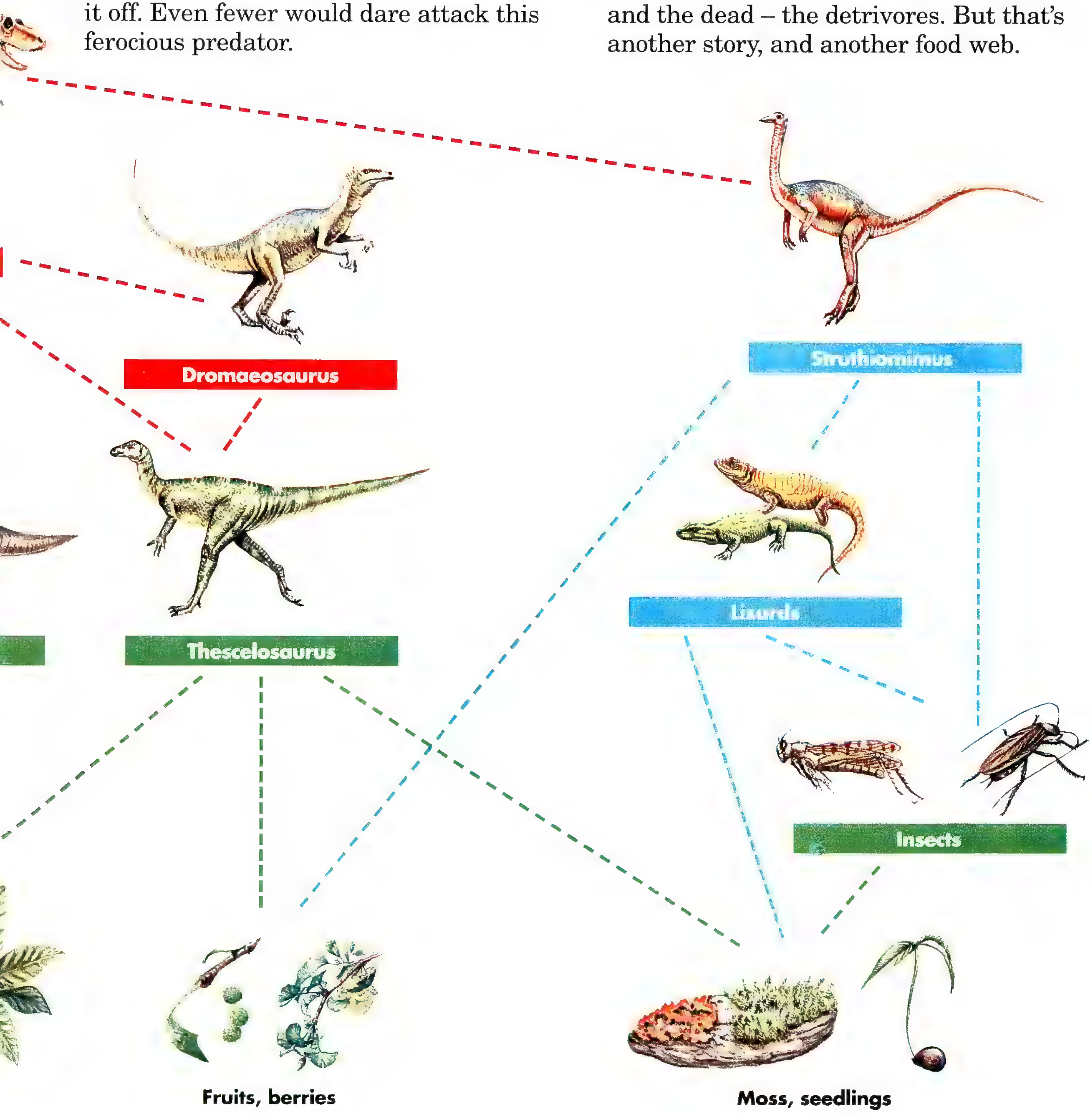


TOP-DOG DINOSAUR

Most food webs have a top carnivore, like the lion in Africa. It preys on almost anything, and almost nothing preys on it. In the dinosaur food web, the top carnivore was almost certainly *Tyrannosaurus rex*. Few animals could fight it off. Even fewer would dare attack this ferocious predator.

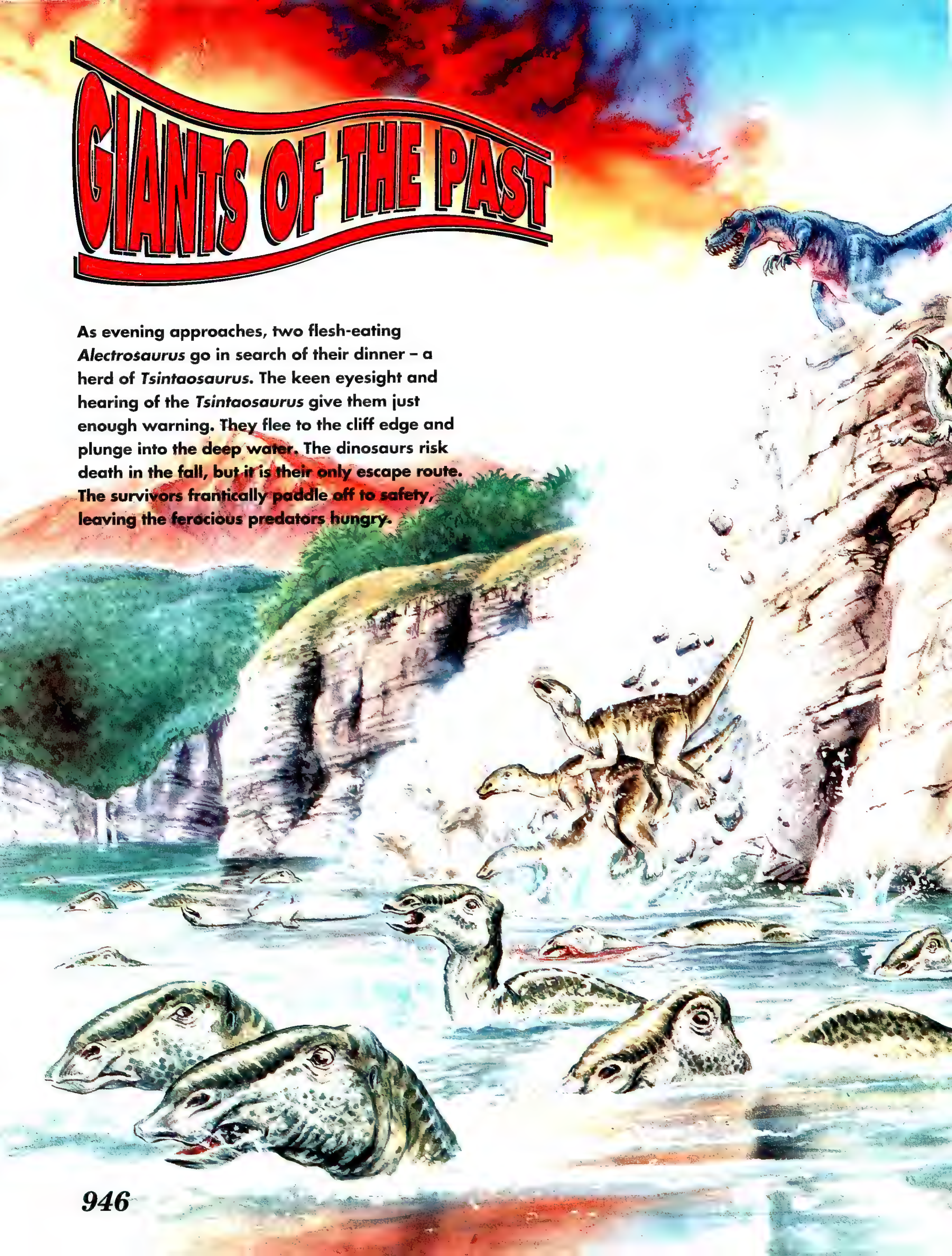
EATING THE DEAD AND DYING

But even a *T rex* eventually died from sickness, or old age. What happened to its body? It may have been eaten by scavengers, (animals that feed on dead bodies) or rotted by fungi. A whole set of living things feeds on the dying and the dead – the detrivores. But that's another story, and another food web.

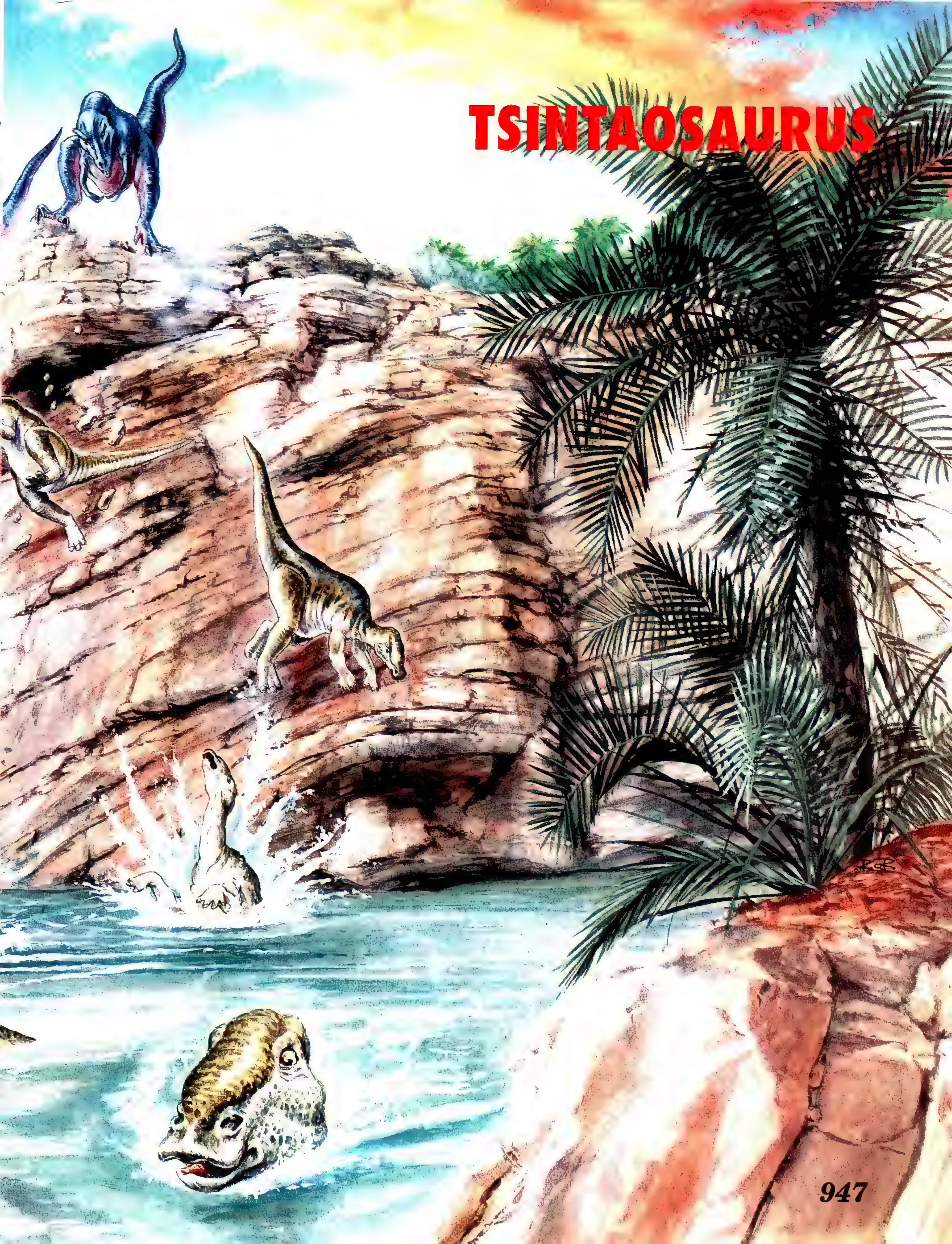


GIANTS OF THE PAST

As evening approaches, two flesh-eating *Alectrosaurus* go in search of their dinner – a herd of *Tsintaosaurus*. The keen eyesight and hearing of the *Tsintaosaurus* give them just enough warning. They flee to the cliff edge and plunge into the deep water. The dinosaurs risk death in the fall, but it is their only escape route. The survivors frantically paddle off to safety, leaving the ferocious predators hungry.

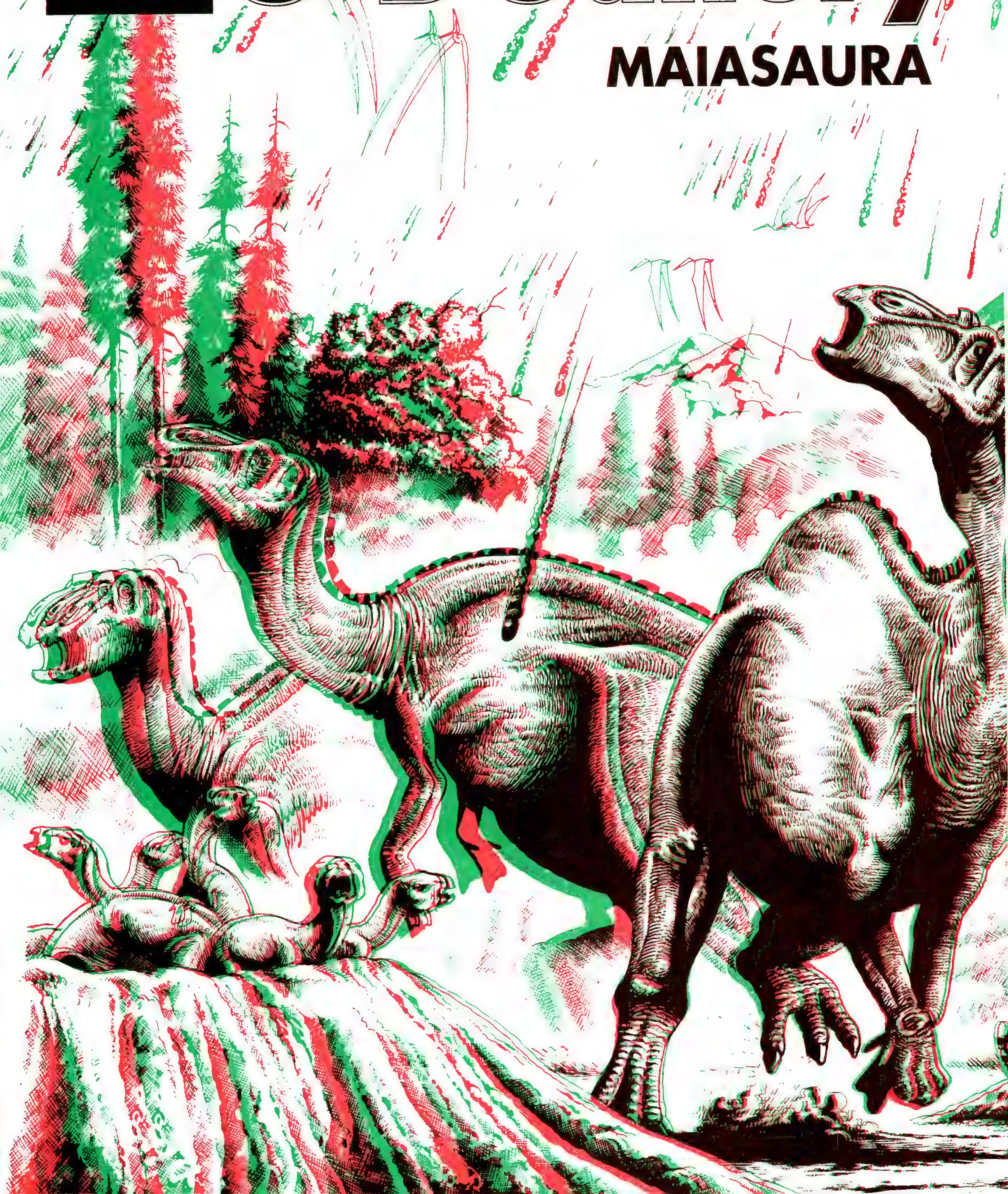


TSINTAOSAURUS



3-D Gallery

MAIASAURA



A peaceful evening in the Late Cretaceous Period is disrupted by a sudden volcanic eruption. Gripped by fear, a *Maiasaura* herd stampedes through its nesting site, desperate to escape the spew of burning, molten lava.

Colours to be seen

Some dinosaurs were probably very brightly coloured, just like many animals today. But why?

There are several reasons why dinosaurs were probably brightly coloured. In nature, bright colours often say 'I am part of your herd', or, 'Keep away, I'm poisonous!'

FANTASTIC CRESTS

It is likely that the fantastic crests of the hadrosaurs were all sorts of colours. They may have been used by the dinosaurs like bright flags, to alert other members of their herd. Their colours would have helped them to stand out in dark forests.

Parasaurolophus **may have had colourful crests so they could easily spot each other. But predators could have spotted them too.**

Animals use colour as a warning. A wasp's yellow and black stripes warn enemies about its sting.

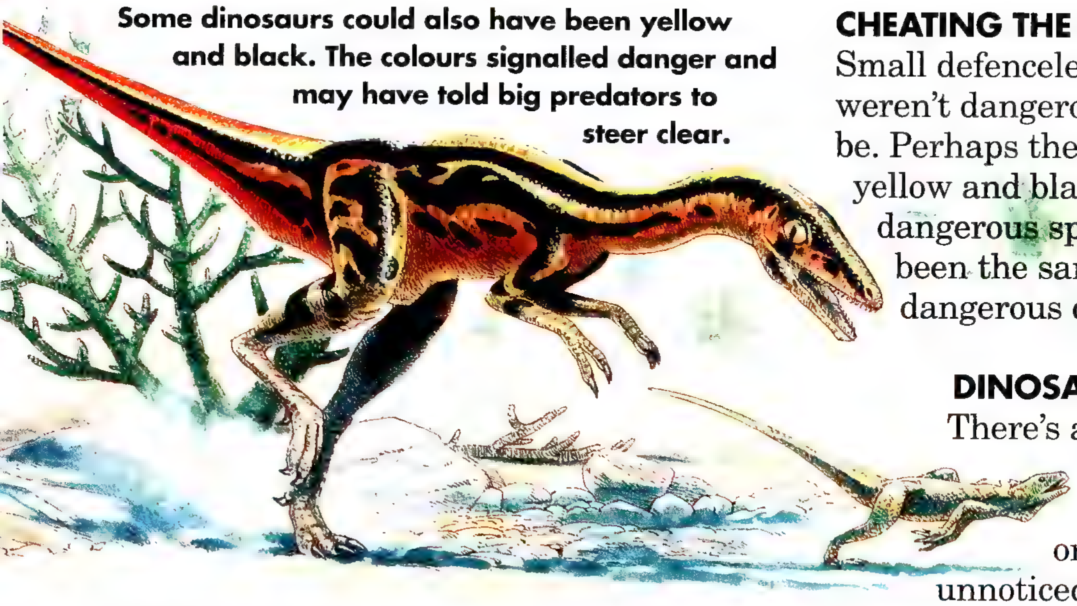
DANGER COLOURS

Have you ever wondered why wasps have yellow and black stripes? In nature, some colours like these spell danger. They tell predators that an animal is poisonous. Red and black are warning colours too.

LEARNING BY EXPERIENCE

Animals learn to associate unpleasant experiences with particular colours. So if they have been stung by a yellow and black wasp, in future they will steer very clear of any animal with the same colours.

The red and black markings of this coral snake mean 'hands off'!



Some dinosaurs could also have been yellow and black. The colours signalled danger and may have told big predators to steer clear.

AMAZING FROGS

It may be that dinosaurs were as brightly coloured as the amazing South American tree frogs. These can be yellow and black, red and black, purple all over or even green with purple legs, red eyes and red feet! The colours tell predators the tree frogs are poisonous. The tree frogs' poison is so strong that it can paralyse a bird or a monkey almost immediately. But the frogs' best defence is really the bright colouring. The danger colours can prevent the tree frogs from being attacked in the first place.

BRIGHT OR DULL

Some animals can be bright or dull according to the circumstances. Butterflies communicate with other members of their species using their bright markings. But the underside of a butterfly is usually a dull brown. When it needs to hide from a predator the butterfly does a quick somersault and then freezes. Maybe dinosaurs were able to do something similar. Ceratopians like *Torosaurus* may have lifted up their frills to tell members of their herd where they were and then tucked them away again if they saw an enemy approaching.

CHEATING THE ENEMY

Small defenceless dinosaurs that weren't dangerous may have pretended to be. Perhaps they were red and black, or yellow and black, the colours of a dangerous species. They may also have been the same size and shape as a dangerous dinosaur.

DINOSAURS IN DISGUISE

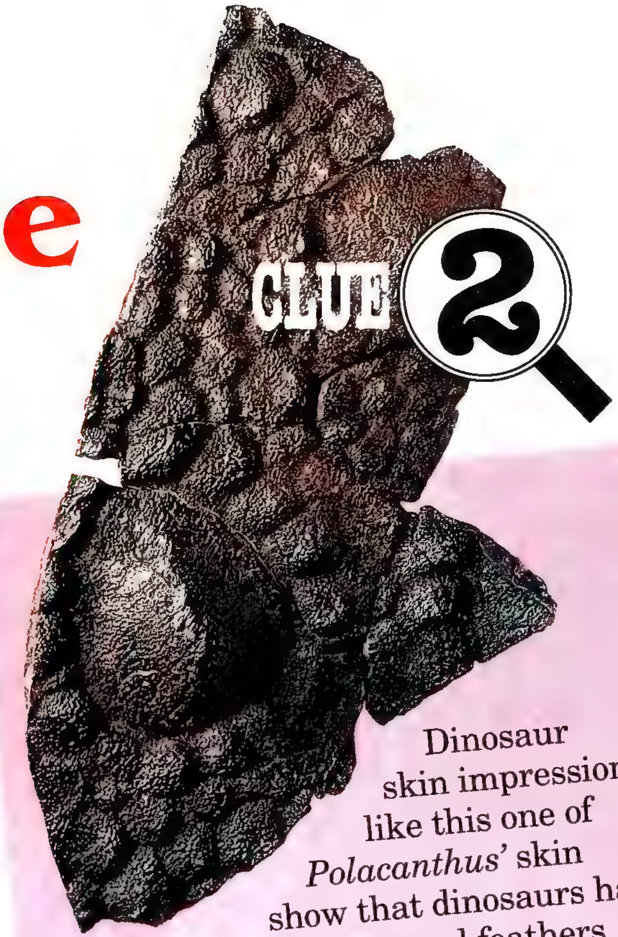
There's a famous story from ancient times about a wolf who dressed up as a sheep in order to get into a herd unnoticed. Scientists say dinosaurs like the carnivorous *Troodon* may have been able to get into a herd of their prey, such as *Orodromeus*, because they were a similar size and colour.

The beauty of this red-eyed, South American tree frog is certainly only skin deep. The bright colours are a warning sign, signalling that the tree frog carries a deadly poison.

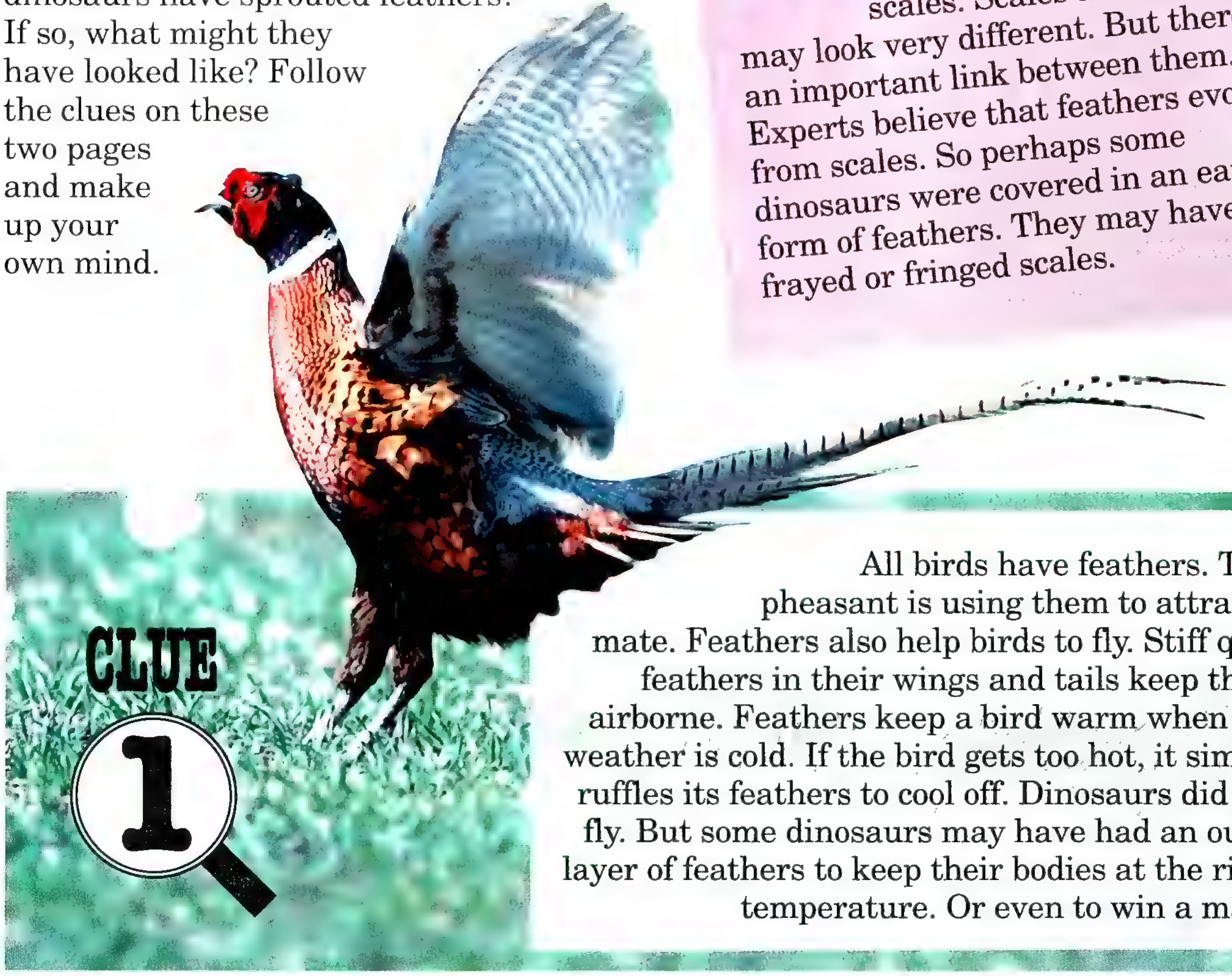
Finding the feathers

We know that dinosaurs had scales. But there are experts who think that some dinosaurs had feathers.

Some scientists now think dinosaurs were more like birds than reptiles. Certain dinosaurs may not have just behaved like birds. They could have looked like birds, too. Could those dinosaurs have sprouted feathers? If so, what might they have looked like? Follow the clues on these two pages and make up your own mind.

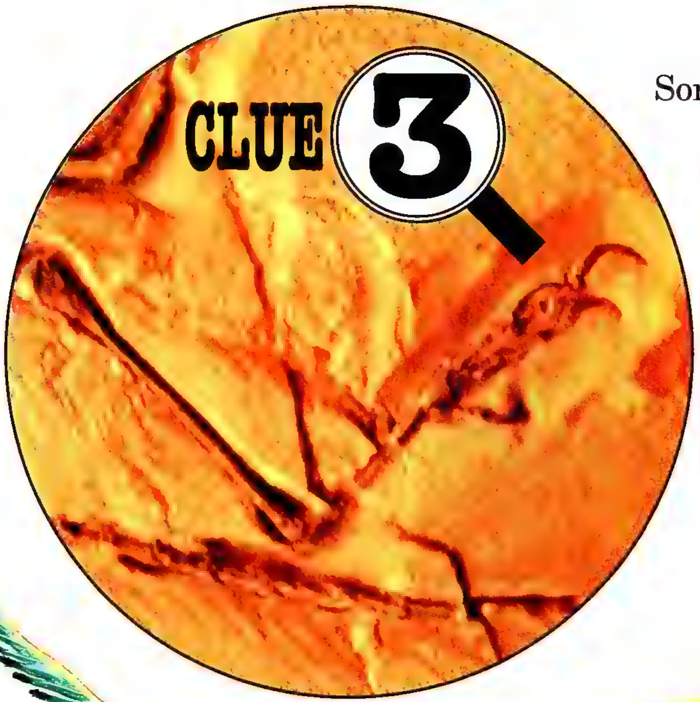


Dinosaur skin impressions like this one of *Polacanthus'* skin show that dinosaurs had scales. Scales and feathers may look very different. But there is an important link between them. Experts believe that feathers evolved from scales. So perhaps some dinosaurs were covered in an early form of feathers. They may have had frayed or fringed scales.



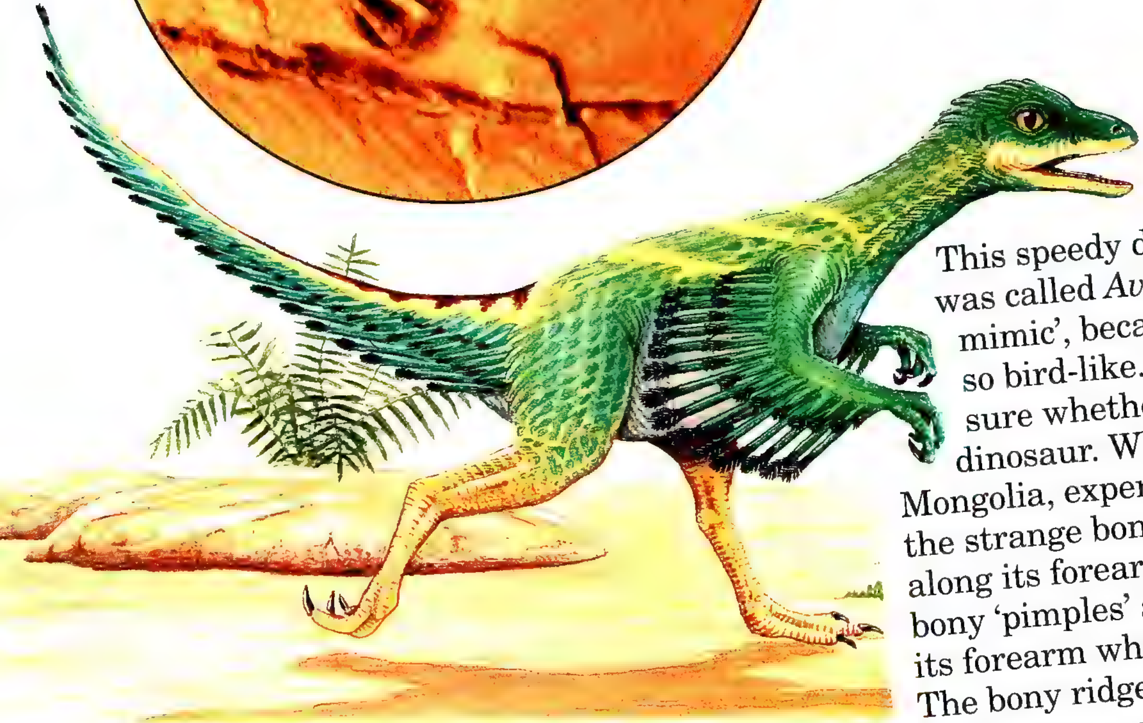
All birds have feathers. This pheasant is using them to attract a mate. Feathers also help birds to fly. Stiff quill feathers in their wings and tails keep them airborne. Feathers keep a bird warm when the weather is cold. If the bird gets too hot, it simply ruffles its feathers to cool off. Dinosaurs did not fly. But some dinosaurs may have had an outer layer of feathers to keep their bodies at the right temperature. Or even to win a mate.

CLUE 3



Some dinosaurs had bird-like bones. Perhaps they grew feathers, like birds. This is the wrist bone of *Archaeopteryx,* the first bird. It is bigger, but identical to, the wrist bone of the meat-eating dinosaur *Deinonychus.* We know that *Archaeopteryx* had feathers. Could *Deinonychus* have had feathers, too?

CLUE 4



This speedy dinosaur was called *Avimimus,* or 'bird-mimic', because its bones were so bird-like. No-one knows for sure whether it was a feathered dinosaur. When it was found in Mongolia, experts were puzzled by the strange bony ridge they found along its forearm. It is similar to the bony 'pimples' a modern bird has on its forearm where the feathers grow. The bony ridge could be proof that *Avimimus* grew feathers, too.

IT'S A FACT

LONG AND SHORT

Baby birds have short, soft feathers. But adult birds have long, stiff feathers. These are made up of millions of tiny barbs or hooks which lock tightly together. They make it possible for a bird to fly.

GOT IT!

Some experts think it's likely that dinosaurs did have feathers. Dinosaurs did not fly. But they may have grown feathers which insulated their bodies. Some scientists believe that only baby dinosaurs had feathers. The baby dinosaurs hatched out covered in soft down, like chicks today, which they shed later as they grew to be adult.

Feathered dinosaurs

Birds may be the closest living relatives of the dinosaurs. Could dinosaurs have grown feathers too?

What makes a bird a bird? It has feathers. No direct evidence exists to prove that dinosaurs had feathers. But certain dinosaurs were very bird-like. Some experts think those dinosaurs could have been covered in feathers, not scales.

ROUGH AND TOUGH

Animal skin usually rots away too quickly to fossilize. But a few dinosaur skin impressions have survived. They show that some dinosaurs had a tough, scaly skin like modern reptiles.

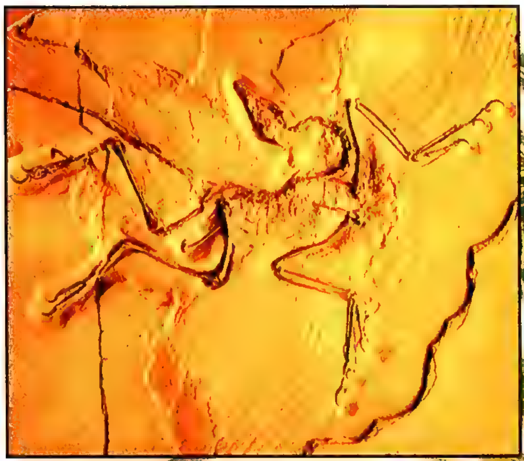
SOFT AND DELICATE

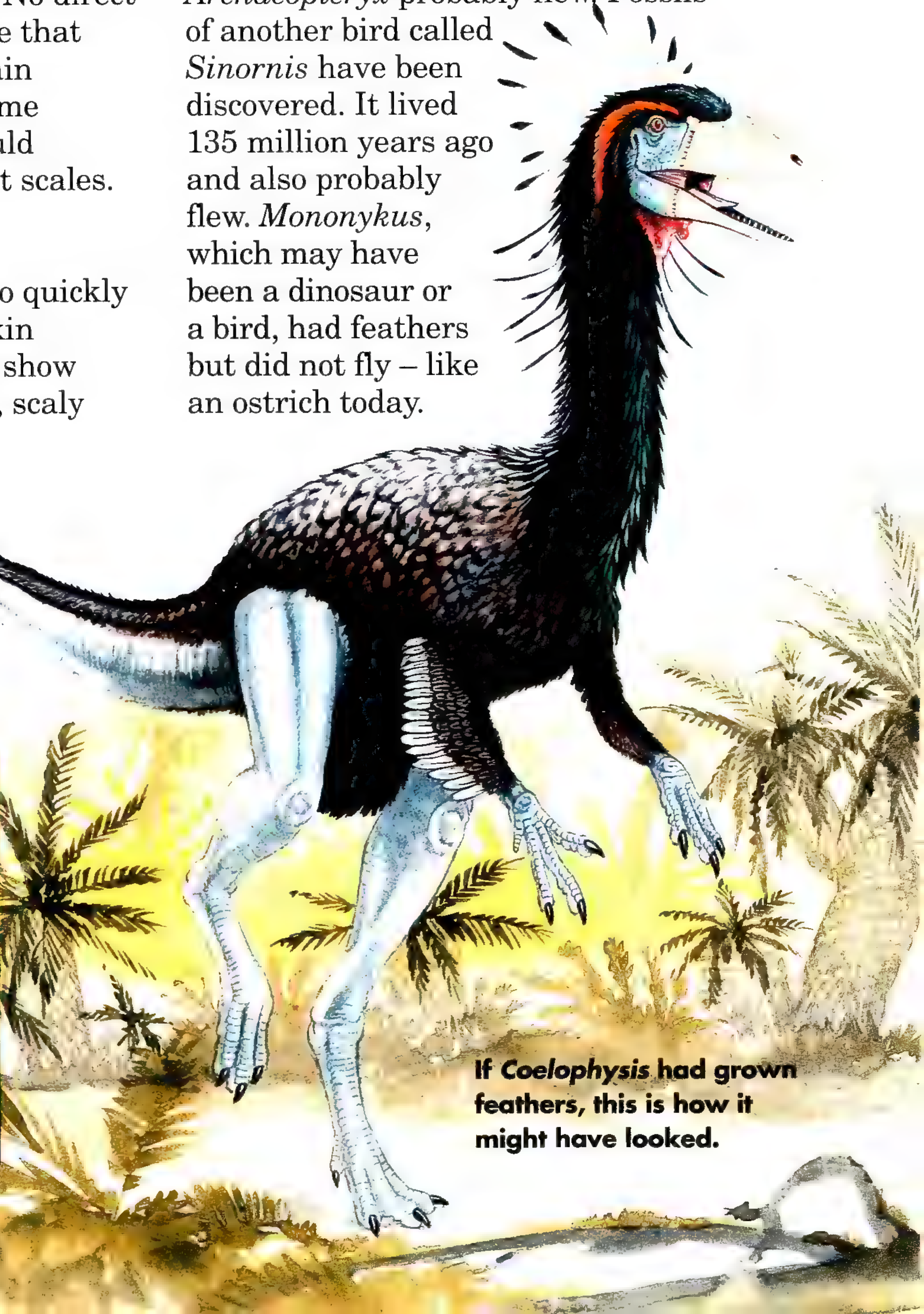
Feathers are not often preserved as fossils. They are too soft and delicate. But some beautifully clear feather impressions have survived from the Age of the Dinosaurs. They belonged to *Archaeopteryx,* a bird that lived almost 150 million years ago.

BIRDS OF A FEATHER

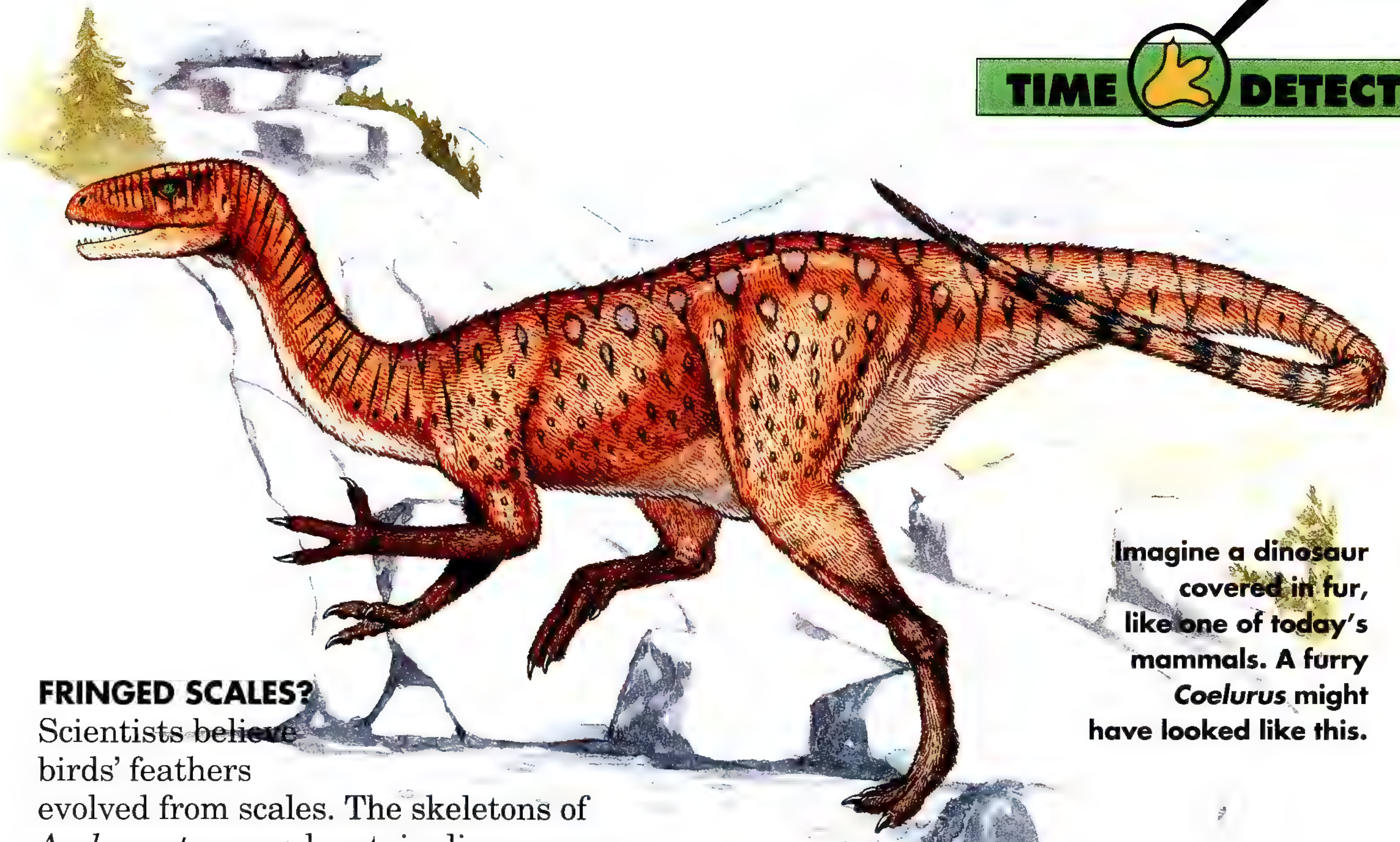
An almost complete fossil skeleton of *Archaeopteryx* has also been found. It shows the impressions of a wide range of feathers. So scientists believe that *Archaeopteryx* probably flew. Fossils of another bird called *Sinornis* have been discovered. It lived 135 million years ago and also probably flew. *Mononykus*, which may have been a dinosaur or a bird, had feathers but did not fly – like an ostrich today.

The discovery of *Archaeopteryx* (below) proved that birds existed 100 million years earlier than anyone had thought.





If *Coelophysis* had grown feathers, this is how it might have looked.



Imagine a dinosaur covered in fur, like one of today's mammals. A furry *Coelurus* might have looked like this.

FRINGED SCALES?

Scientists believe birds' feathers evolved from scales. The skeletons of *Archaeopteryx* and certain dinosaurs are almost identical. So perhaps the most bird-like dinosaurs were covered in an early form of feathers, such as fringed scales.

FAST AND FEATHERED?

Some experts think the speedy dinosaurs *Compsognathus* and *Deinonychus* could have sprouted feathers. But others think much more proof is needed.

FURRY DINOSAURS

If dinosaurs did have feathers they could have looked furry, rather than fluffy, like today's flightless birds. The ostrich has long, fine feathers which look more like hair. Perhaps flightless, bird-like dinosaurs had a similar shaggy covering? Or they might even have grown silky fur, like mammals.

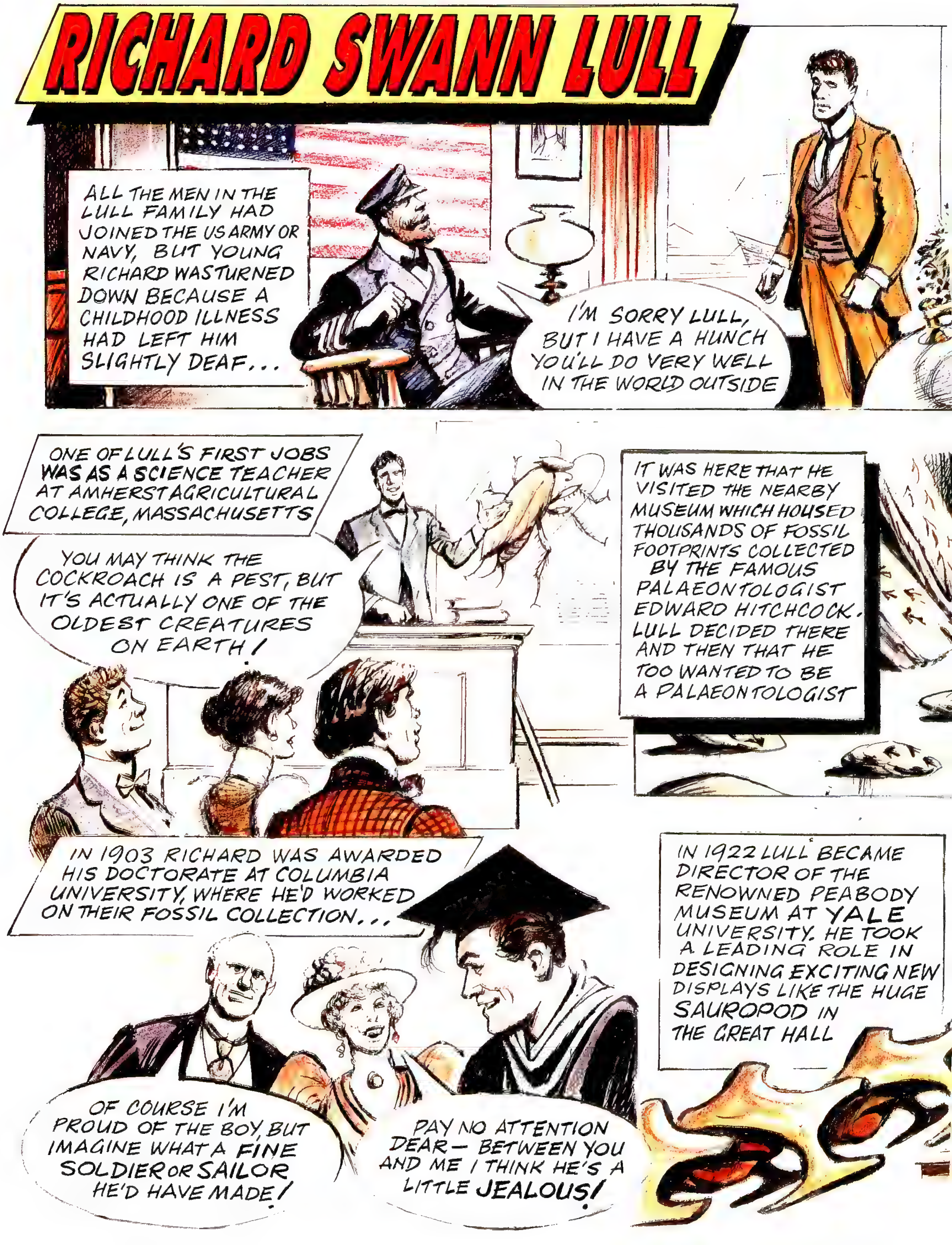
FEATHER FACTS

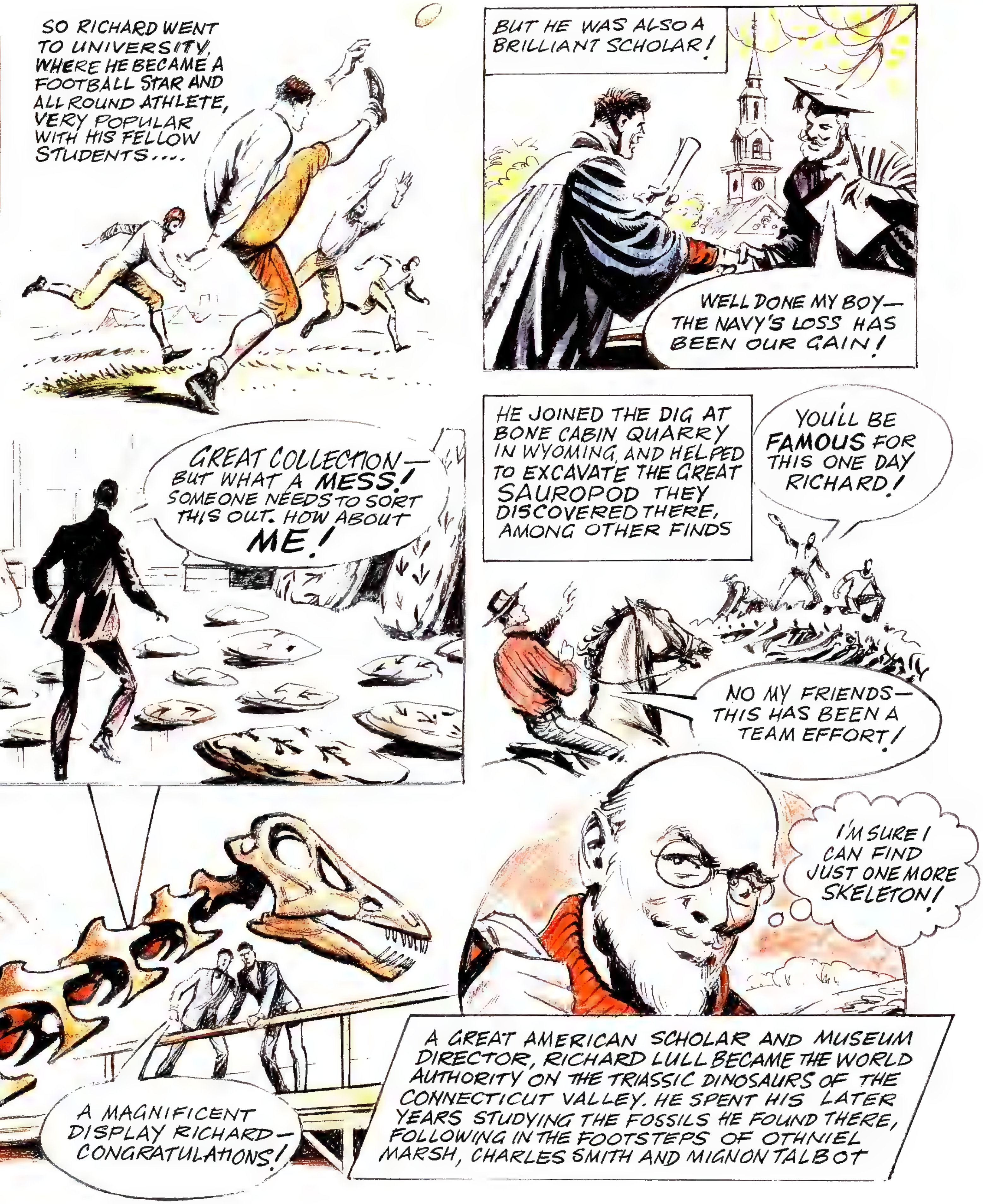
The flicker bird (left) uses its stiff tail to balance itself when feeding its young, or searching for grubs.

Feathers are ideal for keeping a bird's body at the right temperature. Adelie penguins (left) live in the Antarctic. They have extra feathers to keep them warm in the freezing climate there.

Feathers can help birds to hear better. The great grey owl (left) has a huge disc of wiry feathers on its face. They trap tiny sounds and help the owl find its prey.

RICHARD SWANN LULL


ALL THE MEN IN THE LULL FAMILY HAD JOINED THE US ARMY OR NAVY, BUT YOUNG RICHARD WAS TURNED DOWN BECAUSE A CHILDHOOD ILLNESS HAD LEFT HIM SLIGHTLY DEAF...
I'M SORRY LULL, BUT I HAVE A HUNCH YOU'LL DO VERY WELL IN THE WORLD OUTSIDE
ONE OF LULL'S FIRST JOBS WAS AS A SCIENCE TEACHER AT AMHERST AGRICULTURAL COLLEGE, MASSACHUSETTS
YOU MAY THINK THE COCKROACH IS A PEST, BUT IT'S ACTUALLY ONE OF THE OLDEST CREATURES ON EARTH!
IT WAS HERE THAT HE VISITED THE NEARBY MUSEUM WHICH HOUSED THOUSANDS OF FOSSIL FOOTPRINTS COLLECTED BY THE FAMOUS PALAEONTOLOGIST EDWARD HITCHCOCK. LULL DECIDED THERE AND THEN THAT HE TOO WANTED TO BE A PALAEONTOLOGIST
IN 1903 RICHARD WAS AWARDED HIS DOCTORATE AT COLUMBIA UNIVERSITY, WHERE HE'D WORKED ON THEIR FOSSIL COLLECTION...
IN 1922 LULL BECAME DIRECTOR OF THE RENOWNED PEABODY MUSEUM AT YALE UNIVERSITY. HE TOOK A LEADING ROLE IN DESIGNING EXCITING NEW DISPLAYS LIKE THE HUGE SAUROPOD IN THE GREAT HALL
OF COURSE I'M PROUD OF THE BOY, BUT IMAGINE WHAT A FINE SOLDIER OR SAILOR HE'D HAVE MADE!
PAY NO ATTENTION DEAR — BETWEEN YOU AND ME I THINK HE'S A LITTLE JEALOUS!


SO RICHARD WENT TO UNIVERSITY, WHERE HE BECAME A FOOTBALL STAR AND ALL ROUND ATHLETE, VERY POPULAR WITH HIS FELLOW STUDENTS....
BUT HE WAS ALSO A BRILLIANT SCHOLAR!
WELL DONE MY BOY— THE NAVY'S LOSS HAS BEEN OUR GAIN!
GREAT COLLECTION— BUT WHAT A MESS! SOMEONE NEEDS TO SORT THIS OUT. HOW ABOUT ME!
HE JOINED THE DIG AT BONE CABIN QUARRY IN WYOMING, AND HELPED TO EXCAVATE THE GREAT SAUROPOD THEY DISCOVERED THERE, AMONG OTHER FINDS
YOU'LL BE FAMOUS FOR THIS ONE DAY RICHARD!
NO MY FRIENDS— THIS HAS BEEN A TEAM EFFORT!
I'M SURE I CAN FIND JUST ONE MORE SKELETON!
A MAGNIFICENT DISPLAY RICHARD— CONGRATULATIONS!
A GREAT AMERICAN SCHOLAR AND MUSEUM DIRECTOR, RICHARD LULL BECAME THE WORLD AUTHORITY ON THE TRIASSIC DINOSAURS OF THE CONNECTICUT VALLEY. HE SPENT HIS LATER YEARS STUDYING THE FOSSILS HE FOUND THERE, FOLLOWING IN THE FOOTSTEPS OF OTHNIEL MARSH, CHARLES SMITH AND MIGNON TALBOT

Improve and test your knowledge with...

DINO Fact File

Triceratops **holds all the answers. See how you score in the quiz.**

1 What sort of dinosaur was *Silvisaurus*?

- **a) an armoured dinosaur**
- **b) a duckbilled dinosaur**
- **c) a frilled dinosaur**

2 *Tsintaosaurus* was one of the:

- **a) earliest dinosaurs**
- **b) latest dinosaurs**
- **c) smallest dinosaurs**

3 *Prenocephale's* head was protected by:

- **a) thick hair**
- **b) a dome of bone**
- **c) large spikes**

4 Richard Swann Lull was an expert on:

- **a) Triassic dinosaurs**
- **b) dinosaur eggs**
- **c) films about dinosaurs**

5 Which dinosaur may have had feathers on its arms?

- **a) *Baronyx***
- **b) *Allosaurus***
- **c) *Avimimus***

Slumber party with T rex

Ever wanted to spend a whole night with T rex? The Academy of Natural Sciences of Philadelphia has a special safari night, where you can camp among the dinosaur displays. Not for the faint-hearted!

Petrified forest

In the Petrified Forest National Park in Arizona, scientists have found fossils of trees, plants, mammal-like reptiles, fossil footprints and very early dinosaurs. They all lived in the Late Triassic, more than 200 million years ago.

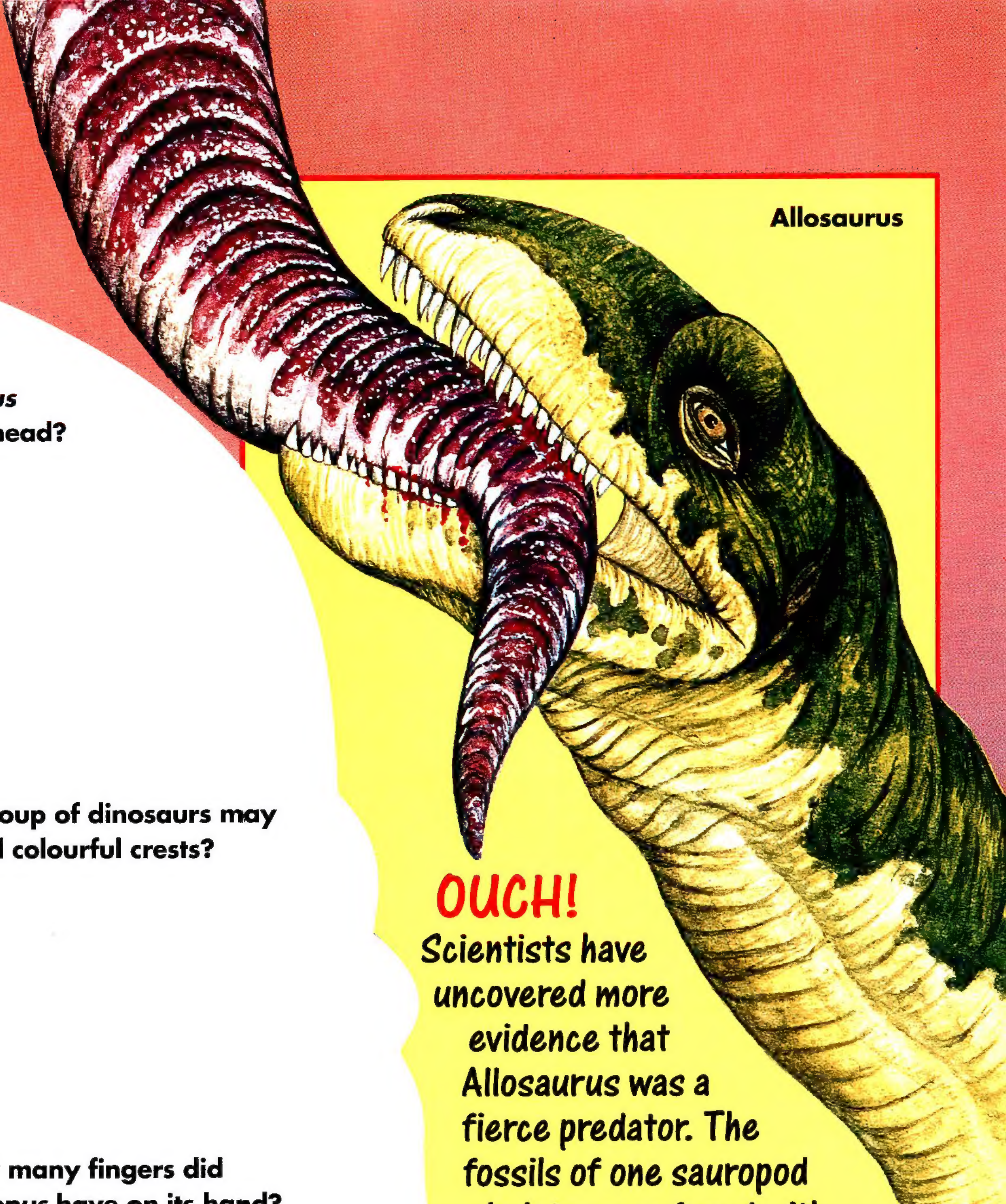
6 What did *Tsintaosaurus* probably have on its head?
- a) a long feather
- b) a crest
- c) a baseball hat

7 What is a herbivore?
- a) a plant-eating animal
- b) a tasty plant
- c) a dragonfly

8 Which group of dinosaurs may have had colourful crests?
- a) hadrosaurs
- b) sauropods
- c) ceratopians

9 What did *Anatotitan* eat?
- a) dinosaurs
- b) plants
- c) insects

10 How many fingers did *Saltopus* have on its hand?
- a) three
- b) two
- c) five



Allosaurus

OUCH!

Scientists have uncovered more evidence that Allosaurus was a fierce predator. The fossils of one sauropod skeleton was found with meat-eating Allosaurus' toothmarks near the end of its tail!

Nature's hand

The rivers that cut through the dinosaur-rich Badlands of southern Alberta in Canada, expose new fossils every year. Who knows – a new discovery could be just around the corner!

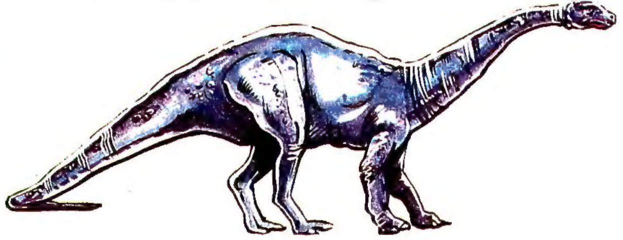
Mononychus muddle

Is Mononychus a prehistoric animal or a beetle? Well, it used to be both! When scientists discovered a turkey-sized creature which lived alongside T rex, they named it Mononychus. Unfortunately the so-called experts didn't know a beetle was already called that. So, Mononychus the prehistoric animal has now been renamed Mononykus!

Answers to the questions on inside back cover

RIOJASAURUS **205 MYA**

Riojasaurus (ree-ok-ah-saw-rus) was a four-legged plant-eater. It lived in South America in the Late Triassic Period and was as long as three cars standing bumper to bumper. *Riojasaurus* had solid limb bones to support its bulky body. Its name means 'Rioja reptile' after La Rioja, a city in Argentina.



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SAICHANIA **70 MYA**

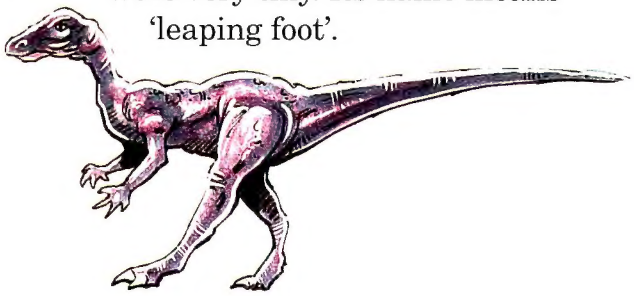
A variety of knobbly bumps and spikes guarded the head, neck and back of this four-legged armoured dinosaur. *Saichania* (sy-charn-ee-a) means 'beautiful'. It was found in the Gobi Desert, southern Mongolia. As long as an elephant, *Saichania* had the added protection of a bony tail club as it fed among low-growing plants.

SALTASAURUS **70 MYA**

Five incomplete skeletons of *Saltasaurus* (salt-a-saw-rus) were found in 1970. The fossils were surrounded by thousands of bony plates of various sizes. It was an exciting find because *Saltasaurus* was the first known sauropod to have any sort of armour. Its name means 'Salta reptile' after a city in Argentina, South America. Plant-eating *Saltasaurus* was longer than a bus and walked on four legs.

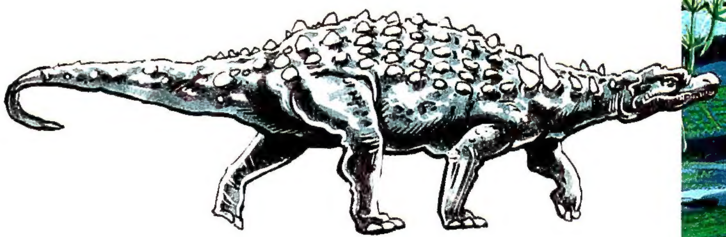
SALTOPUS **210 MYA**

The fossils of little *Saltopus* (salt-oh-pus) were discovered in the sandstone of north-east Scotland in 1910. It was a tiny, agile dinosaur, only 60cm long and it weighed less than 1kg. It probably lived on insects and small, lizard-like animals. *Saltopus* had five fingers on each hand, but two of them were very tiny. Its name means 'leaping foot'.



SARCOLESTES **170 MYA**

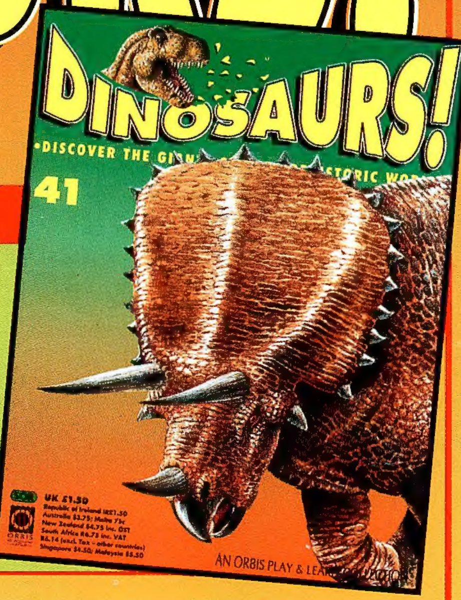
Although its name means 'flesh-robber', *Sarcolestes* (sark-oh-less-teez) was not a meat-eater, but one of the earliest known armoured nodosaurs. It lived in the Mid Jurassic Period and was a peaceful plant-eater about as long as a rhinoceros. *Sarcolestes* was protected from predators by an armour of bony plates and spikes. Part of its jaw was found in Cambridgeshire, southern England.



MYA = MILLION YEARS AGO

COMING IN PART 41 OF

DINOSAURS!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Discover how a hunting dinosaur like *Staurikosaurus* attacked its prey in TIME DETECTIVE. Find out about the dinosaurs' colourful courting displays in SPOTTER'S GUIDE.

PLUS

Meet a frilly-necked head-swinger and two other great dinosaurs in IDENTIKIT
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THE DINOSAURS! POSTER COLLECTION

Have you ever wanted to fill your room with dinosaurs? Now you have your chance – with the *Dinosaurs!* POSTER COLLECTION. Each poster is 820 x 570mm (nearly eight times the size of this page) and features a superb dinosaur artwork. You'll find facts and figures about the dinosaur on the back – PLUS a look at some other prehistoric animals. The twelfth poster is *Brachiosaurus*.

PICTURE CREDITS: front cover: Stephen Message/Wildlife Art Agency. FLPA 942; Natural History Museum, London IFC, 938 T, 952; Natural History Museum/John Sibbick 945 BR; NHPA 950 TR, 950 C, 951 BR, 952 BL, 955 BL; Oxford Scientific Films 953 TL, 954 BL, 955 BC, 955 BR. **Artwork:** Black Hat 960; Robin Boutell/WLAA 941 B, 946/7; Catherine Constable 943, 944/5; Barry Croucher/WLAA 945 BL; Mike Donnelly 945 R; Edwina Goldstone/WLAA 959; Deidre McHale 961; Stephen Message/WLAA 937, 939; James Robins 951 TL; Craig Robson/WLAA 953 B; Graham Rosewarne 954 R, 955 T; David Street/WLAA 940 B; Steve Weston 950 B; Steve White 948/9; Pat Williams 956/7.

ANSWERS TO DINO FACT FILE QUESTIONS: 1.a 2.b 3.b 4.a 5.c 6.b 7.a 8.a 9.b 10.c

Dr. David Norman of Cambridge University answers your dinosaur questions

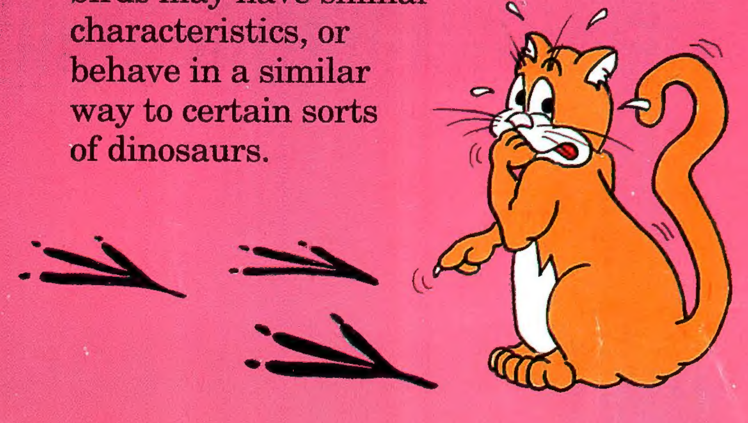
ASK THE EXPERT

Did dinosaurs ever see snow?

There is evidence that temperatures dropped to freezing point in some parts of the world towards the end of the reign of the dinosaurs. Dinosaurs like the late tyrannosaurs, duckbills and ceratopians may have been caught near the North Pole at the end of the feeding season if they hadn't migrated south fast enough when temperatures started to fall. So dinosaurs probably did see snow.

Is it true that birds are modern dinosaurs?

Although this is a nice idea, it is not true. Birds are not dinosaurs, and dinosaurs are not birds. No dinosaur ever flew. But birds are the nearest living relatives of the dinosaurs – or at least of the small carnivorous dinosaurs. So some of today's birds may have similar characteristics, or behave in a similar way to certain sorts of dinosaurs.



What happens to the dinosaur bones not displayed in museums?

Museum visitors usually only see the nicest fossils. The rest of the material, which doesn't look so nice, but may be important to palaeontologists, goes into the museums' special stores. The bones are looked after by the museum staff. They are kept clean, specially labelled and conserved, so that they can be studied by scientists from all over the world.

How did big sauropods lie down?

I do not think that adult sauropods did lie down. These dinosaurs were extremely large and heavy. When they were standing they were cleverly balanced so that the weight of the tail equalled the weight of the neck and their back muscles were not strained. Their legs were very straight and, like birds today, they could probably stand stock-still quite happily, for long periods of time. Folding their legs to crouch or lie, and so putting huge loads on the legs, could easily have caused the bones to snap.

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